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(54) Title: A CONNECTOR FOR HIGH-PRESSURE METAL PIPES			
(57) Abstract			
<p>A connector for high-pressure metal pipes comprising a tubular body (12) having an external thread (28) coaxial with a cavity (22, 24) for housing an end portion of the pipe (40), a metal cutting ring (30) having a sealing portion (34) which, in use, is wedged between the cavity (22) of the tubular body (12) and the outer surface of the pipe (40), and a clamping element (54) having an internal thread (56) which, in use, engages the external thread (58) of the tubular body (12). The connector comprises a sealing element (48) of elastomeric material which, in use, is interposed between the cutting ring (30) and the clamping element (54).</p>			

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A connector for high-pressure metal pipes

The present invention relates to a connector for high-pressure metal pipes, particularly stainless- or carbon-steel pipes, of the type comprising:

- a tubular body having an external thread coaxial with a cavity for housing an end portion of a pipe,
- a metal cutting ring having a sealing portion which is driven into the cavity of the tubular body in use, the sealing portion having at least one annular cutting edge which, in use, cuts the outer surface of the pipe, and
- a clamping element having an internal thread which engages the external thread of the tubular body in use, exerting on the metal cutting ring an axial thrust which drives the sealing portion into the cavity.

Connectors of the type specified above are produced in accordance with DIN standard 2353. These connectors enable piping which can be disassembled to be produced quickly, avoiding weldings, screw-cuttings and widenings, achieving maximum simplification of the production of the system. The screwing-up of the clamping element wedges the cutting ring between a tapered surface of the body of the connector and the outer surface of the pipe forming an incision in the outer surface of the pipe.

Clamping rings having two cutting edges, in accordance with DIN standard 3861, are generally used. Rings of this type form a first incision which can be inspected visually in the region of the outer cutting edge, and

ensure hermetic and leaktight sealing of the pipe ring. The inner cutting edge forms a second incision which cannot be inspected visually but which helps to distribute the forces equally over the entire ring, to prevent vibrations from reaching the first incision, and to stop the clamping of the pipe at a predetermined value.

The reliability and sealing of connectors of this type are ensured only if the assembly instructions provided by the manufacturer are followed carefully. In particular, the pipe to be connected to the connector must be cut at right angles without the use of roller pipe cutters. Internal and external trimmings of the pipe must be carried out to ensure that the pipe is in abutment with a shoulder inside the body of the connector throughout the clamping stage. Before assembly, the conical portion of the connector body, the thread of the body, the cutting ring and the clamping nut have to be lubricated with suitable products (mineral oils for carbon-steel connectors, or nickel anti-seizing compounds for stainless-steel connectors).

At this point, the pipe is inserted in the cavity of the connector body until it bears against the stop abutment of the connector and the nut is tightened with hand force until it can be felt that the cutting ring is bearing well on the clamping nut. The nut then has to be screwed up with a spanner until the cutting edge of the ring comes into contact with the pipe and prevents its rotation. The clamping nut must then be screwed up by three quarters of a turn with the pipe held against its stop and prevented from rotating. The cutting edge of the

ring thus cuts the external portion of the pipe to the required depth and forms a raised portion in front of the cutting edge. The nut then has to be unscrewed to check that there is a well-raised portion all around the pipe. The raised portion must cover 70% of the face of the cutting ring. The pre-assembled pipe can then be fitted on a machine and the nut closed with a spanner until a certain resistance is felt and, from this moment, screwed for a further quarter of a turn with one spanner in opposition to another spanner.

Experience has shown that assemblers frequently do not follow the assembly procedure with due care, which involves the risk that leakages of fluid or loosenings of the connector due to vibrations may occur in operation.

The document US-A-2,437,632 describes a connector having the characteristics contained in the preamble to Claim 1. This connector has a toroidal sealing ring which is compressed axially between the cutting ring and the body of the connector in use. In the deformed condition, the seal engages a smooth internal surface of the clamping element.

A problem with the connector described in the document US-A-2,437,632 is that the clamping element may loosen if subjected to vibrational stresses in combination with high pressure for long periods of time.

The document US-A-2,529,552 describes a different solution which has the object of providing a connector which can withstand the effect of vibrations and high pressure for a prolonged period of time without yielding.

According to US-A-2, 529, 552, a seal of elastomeric material surrounds the entire cutting ring or a substantial portion thereof including the sealing portion bearing the cutting edge.

The solution described in US-A-2, 529, 552 has the disadvantage of requiring the use of a pre-assembly body other than the final connector body. Moreover, during assembly, a portion of the sealing ring is driven into the cavity of the connector body and the seal is stressed torsionally during the tightening of the nut. This stressing of the seal may cause it to yield, particularly if the connector is disassembled and reassembled several times.

The object of the present invention is to provide improvements to high-pressure, sealing connectors which overcome the problems of the known solutions, preventing leakages of fluid or loosenings of the clamping nut under the effect of vibrations of the system, even if the assembly procedure is not carried out with the necessary care.

According to the present invention, this object is achieved by a connector having the characteristics forming the subject of Claim 1.

According to the invention, the clamping nut of the connector is prevented from unscrewing by means of the deformation of the sealing element, which is preferably constituted by a flat seal which is pressed between two facing frontal surfaces of the connector body and of the cutting ring. This deformation brings about an increase

in the diameter of the seal until it engages the threads of the clamping nut which are free from engagement with the thread of the connector body. This locks the clamping nut and in fact prevents it from becoming unscrewed even in the presence of prolonged vibrations.

The connector can be assembled and disassembled without problems since, at the assembly stage, the flat seal is not yet deformed and has an outside diameter which does not interfere with the internal thread of the clamping nut. At the disassembly stage, as soon as the nut is released by the spanner, the diameter of the seal reduces, leaving the nut free to be unscrewed even by hand without hindrance.

As well as solving the problem of the nut becoming unscrewed, the invention also solves the problems of ensuring hermetic sealing of the connector.

The connector according to the invention also has considerable practicality by virtue of the fact that it does not alter currently-used assembly procedures in any way. Another advantage of the invention is that it enables the clamping of the mouth of the metal pipe to be checked in accordance with the normal standards. The components of the connector according to the invention are interchangeable with all known products currently available on the market. The solution according to the invention also has the advantage of cheapness since the basic structure is the same as the previously known connector so that no substantial modifications of production tooling are required.

Further characteristics and advantages of the present invention will become clear in the course of the following detailed description given purely by way of non-limiting example, with reference to the appended drawings, in which:

Figure 1 is a partially-sectioned, exploded side elevational view of a connector according to the present invention,

Figure 2 is a partially-sectioned view of the connector of Figure 1 in the assembled configuration,

Figure 3 is a schematic section showing the connector according to the invention, on an enlarged scale, in a pre-assembly configuration, and

Figure 4 is a section similar to that of Figure 3 showing the connector according to the invention in the assembled configuration.

With reference initially to Figures 1 and 2, a connector, indicated 10, for high-pressure oleodynamic systems is intended, in particular, for connecting stainless-steel and carbon-steel pipes. The connector 10 comprises a tubular body 12 having a hexagonal portion 14 and an attachment portion 16. The tubular body 12 has a through-hole 18 which, in the attachment portion 16, opens into a cavity 20 constituted by a conical mouth 22 and by a cylindrical portion 24 terminating in a shoulder 26. The outer surface of the attachment portion 16 has a thread 28.

The connector 10 comprises a metal cutting ring 30 having an inclined thrust portion 32 at a first end. The second end of the cutting ring 30 is constituted by a deformable sealing portion 34 having two annular cutting edges 36, 38 which cut the outer surface of a pipe 40 in use. The sealing portion 34 has a conical outer surface 42 which cooperates with the conical surface 22 of the tubular body 12. The cutting ring 30 has a cylindrical outer surface 44 terminating against a shoulder 46, onto which a flat seal 48 made of elastomeric material, that is, a seal having a rectangular generator section, is fitted. The flat seal 48 has an outer surface 49 which, in the undeformed conditions, is substantially flush with a cylindrical surface of the head 51 of the cutting ring 30. The internal surface of the cutting ring 30 has an annular seat 50 in which a sealing ring 52 of elastomeric material (an O-ring) is fitted.

A clamping nut 54 has a threaded hole 56 which engages the thread 28 of the connector body 12. The clamping nut 54 has a second hole 58 of smaller diameter, through which the end portion of the pipe 40 extends. At the inner edge of the hole 58, the nut 54 has an inclined surface 60 which cooperates with the inclined thrust surface 32 of the cutting ring 30.

The assembly sequence of the connector according to the invention is identical to that for connectors of the prior art described in the introduction to the description.

With reference to Figure 3, it will be noted that, before assembly, the flat seal 48 has an outside diameter

smaller than the diameter of the thread 56 of the clamping nut 54 so as to allow the cutting ring 30 to be inserted freely in the clamping nut 54. The O-ring 52 establishes a sealing contact with the outer surface of the pipe 40. The sealing portion 34 of the cutting ring 30 is driven into the conical surface 22 of the connector body 12. When the nut 54 is tightened, an axial thrust is exerted on the cutting ring 30 by virtue of the contact between the inclined surfaces 60 and 32.

The sealing portion 34 is deformed progressively as the cutting ring 30 is gradually urged into the conical cavity 22. The cutting edges 36 and 38 thus cut the outer surface of the pipe 40 forming a fluid-tight anchorage.

Figure 4 shows the connector fully assembled. It can be seen that the cutting edges 36 and 38 produce respective raised portions of material 62 and 64 and are driven firmly into the surface of the pipe 40.

During the tightening of the nut 54, the flat seal 48 is compressed between the shoulder 46 and the front surface 66 of the connector body 12. This compression causes radial expansion of the seal 48. In the deformed condition, the outer surface 49 of the seal 48 engages with sealing contact in some threads 56 which remain free of engagement with the external thread 28 of the connector body 12.

In the deformed configuration shown in Figure 4, it can be seen that the seal 48 has an axial width greater than the pitch of the thread 56 so as to engage at least two

adjacent threads. The solid seal 48 thus forms a sealing region between the clamping nut 54 and the cutting ring 30. The sealing ring 52 defines a second sealing region between the cutting ring 30 and the outer surface of the pipe 40. These two sealing regions can prevent leakages of fluid or oozing if, for example, because of an assembly procedure not carried out in accordance with the instructions, a leakage occurs through the principal sealing region formed on the contact surfaces between the sealing portion 34, the outer surface of the pipe 40 and the conical surface 22. The flat seal 48 which engages the thread 56 of the clamping nut 54 also performs the function of a device for preventing unscrewing, preventing the clamping nut 54 from loosening under the effect of vibrations.

CLAIMS

1. A connector for high-pressure metal pipes, comprising:

- a tubular body (12) having an external thread (28) coaxial with a cavity (22, 24) for housing an end portion of a pipe (40),
- a metal cutting ring (30) having a sealing portion (34) which is driven into the cavity (22) of the tubular body (12) in use, the sealing portion (34) having at least one annular cutting edge (36, 38) which, in use, cuts the outer surface of the pipe (40),
- a clamping element (54) having an internal thread (56) which, in use, engages the external thread (28) of the tubular body (12) exerting on the cutting ring (30) an axial thrust which drives the sealing portion (34) into the cavity (22), and
- a sealing element (48) of elastomeric material which, in use, is compressed axially between the cutting ring (30) and the tubular body (12) and establishes a sealing contact with the clamping element (54),

characterized in that the sealing element (48) engages the internal thread (56) of the clamping element (54) with sealing contact in use.

2. A connector according to Claim 1, characterized in that the sealing element comprises a flat seal (48) having a substantially cylindrical outer surface (49) which, in the undeformed conditions, is spaced radially

from the internal thread (56) of the clamping element (54).

3. A connector according to Claim 2, characterized in that, in use, the sealing element (48) is compressed axially between two facing frontal surfaces (46, 66) of the cutting ring (30) and of the tubular body (12) and in that, as a result of this axial compression, the sealing element (48) expands radially until it engages the internal thread (56) of the clamping element (54).

4. A connector according to Claim 2, characterized in that the sealing element (48) has an axial length equal to or greater than the pitch of the internal thread (56) of the clamping element (54).

5. A connector according to Claim 2, characterized in that the sealing element (48) is fitted onto a cylindrical surface (44) of the cutting ring (30) and is held on the cutting ring (30) without any restraint which prevents the axial compression and radial expansion of the sealing element (48).

6. A connector according to Claim 1, characterized in that it comprises a second sealing element of elastomeric material interposed between the cutting ring (30) and the outer surface of the pipe (40).

7. A connector according to Claim 6, characterized in that the second sealing element is an O-ring (52) housed in an annular seat (50) formed in the internal surface of the cutting ring (30).

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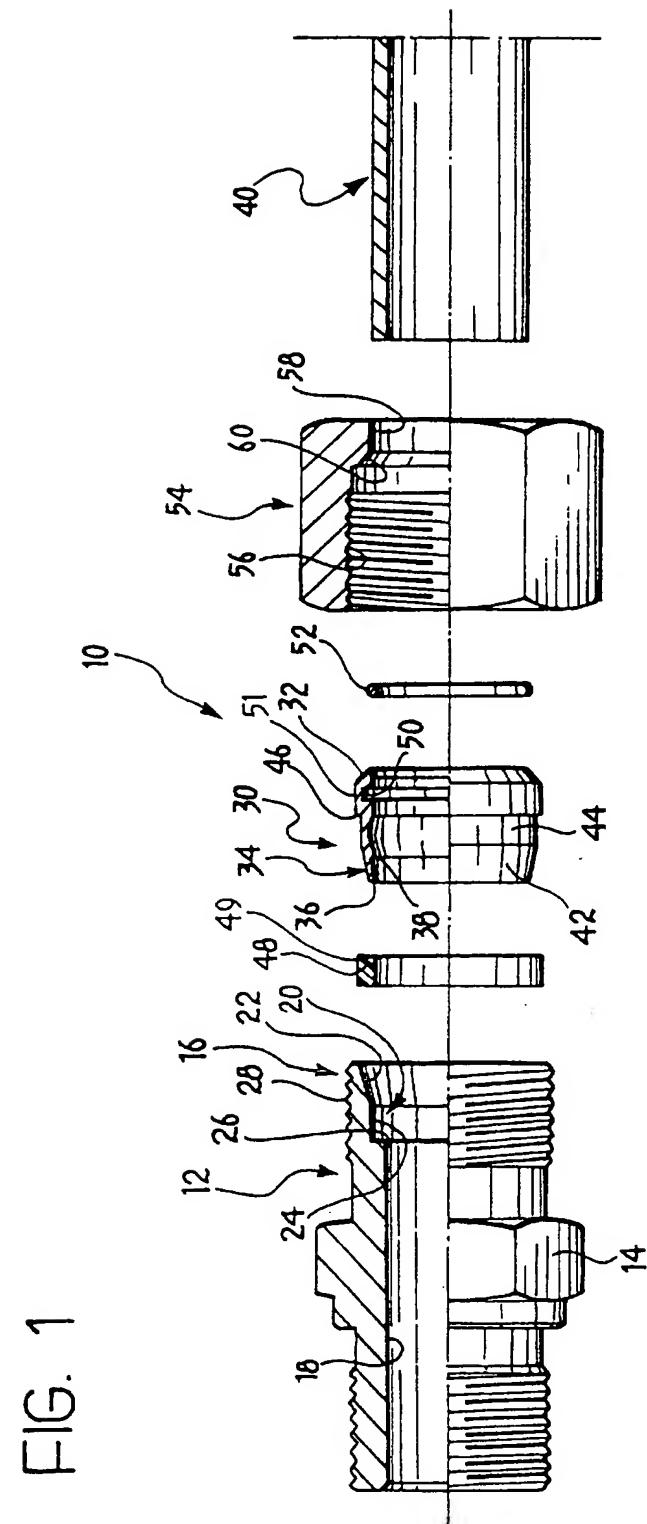


FIG. 1

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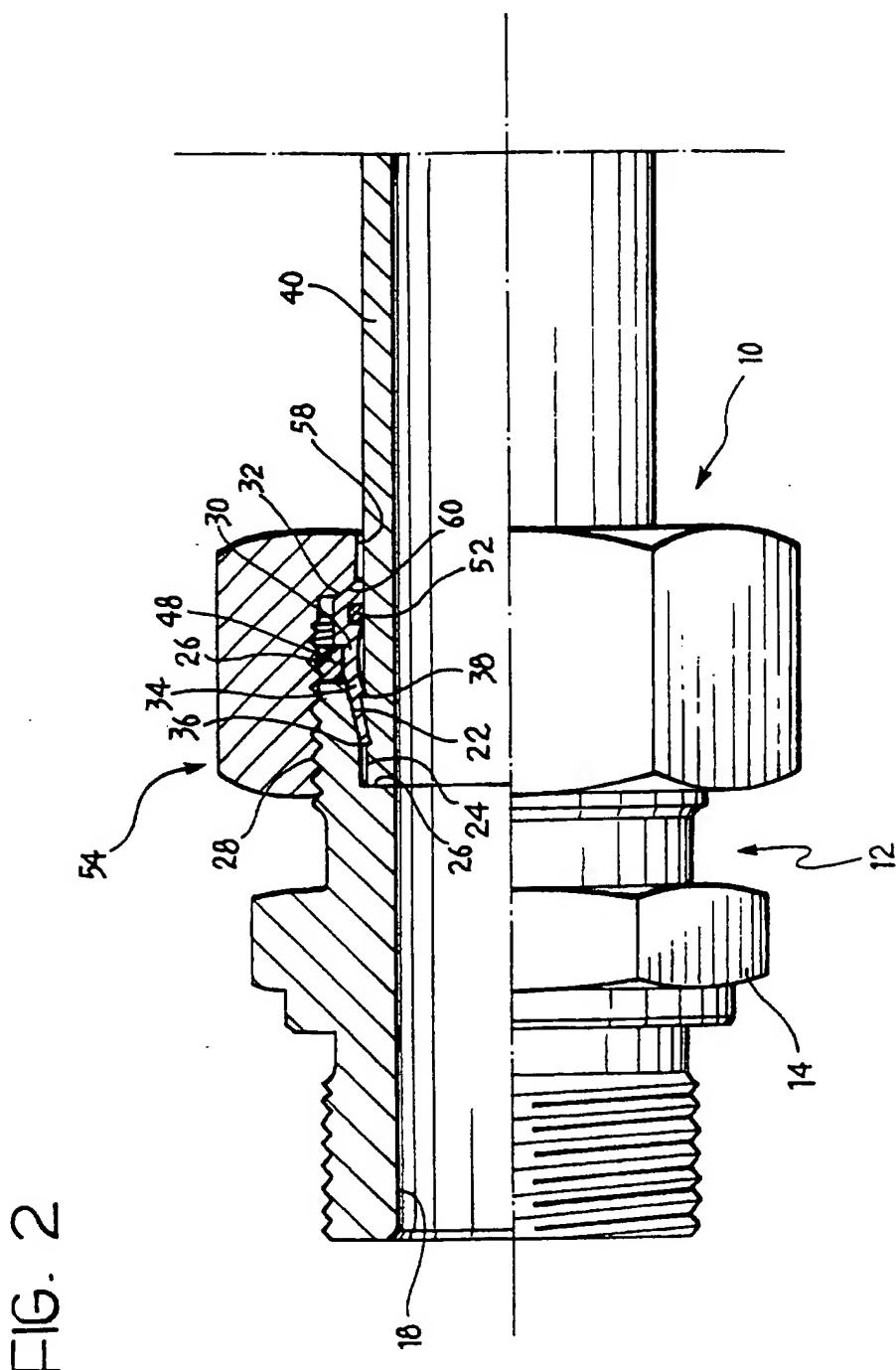


FIG. 2

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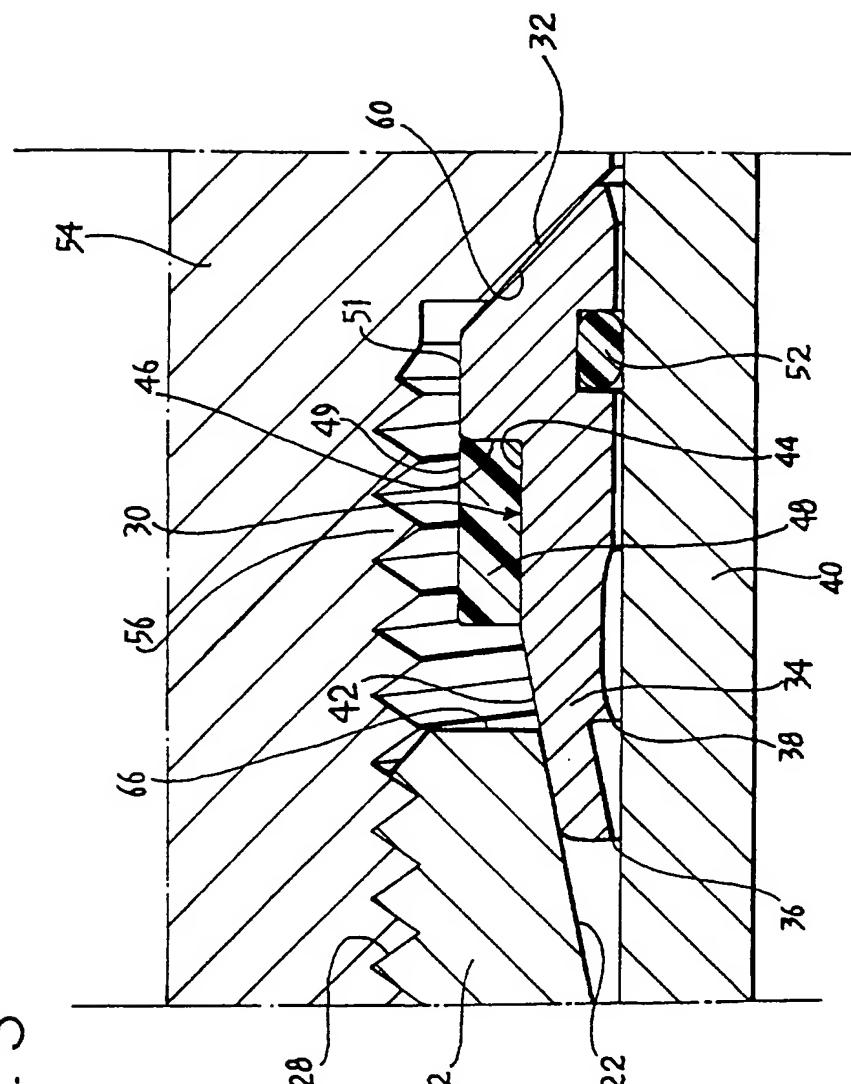
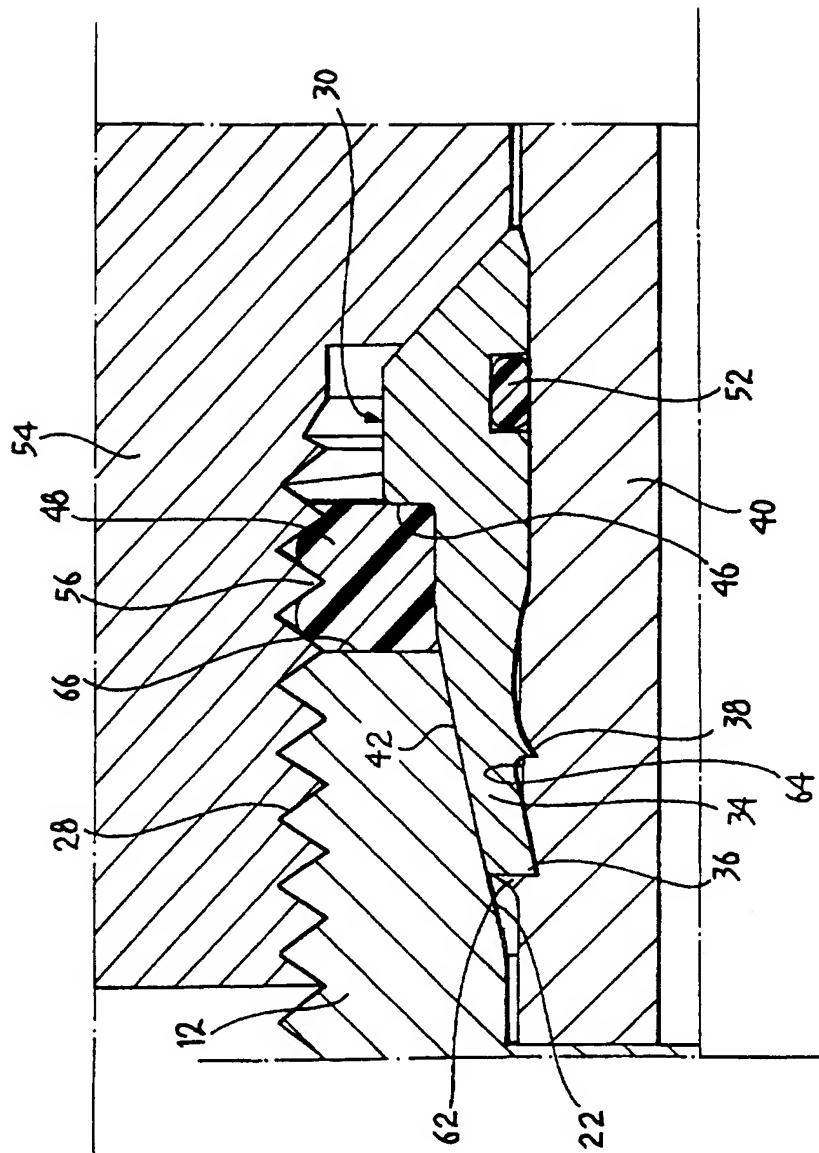


FIG. 3

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FIG. 4



INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/EP 96/05196

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 F16L19/08 F16L19/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 F16L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2 529 552 A (HEROLD) 14 November 1950	1-5
Y	see column 1, line 45 - column 2, line 5; claim 1; figures	6,7
Y	---	
A	US 2 437 632 A (WOLFRAM) 9 March 1948	6,7
A	see column 2, line 9 - line 12; figures	1-5
A	---	
A	US 3 248 135 A (MERIPOL) 26 April 1966	1-7
A	see figures	
A	---	
A	BE 470 104 A (COMPAGNIE DES FREINS & SIGNAUX WESTINGHOUSE) 31 January 1947	1-7
A	see page 5, line 28 - line 31; claim 5; figures	
A	---	
A	US 3 275 350 A (KODY ET AL.) 27 September 1966	1-5
A	see figures	

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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1 Date of the actual completion of the international search	Date of mailing of the international search report
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Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2529552 A	14-11-50	NONE	
US 2437632 A	09-03-48	NONE	
US 3248135 A	26-04-66	NONE	
BE 470104 A		NONE	
US 3275350 A	27-09-66	NONE	